WE CLAIM:

1. A method of synthesizing sound signals associated with a vehicle having an engine, comprising:

providing at least one engine control parameter which characterizes a corresponding engine operating condition,

providing at least one vehicle control parameter which characterizes a corresponding vehicle operating condition other than an engine operating condition,

generating at least one engine related sound signal corresponding to said engine control parameters, and

generating at least one vehicle sound signal corresponding to said vehicle control parameters.

2. The method of claim 1, at least one of said vehicle control parameters comprising vehicle speed.

3. The method of claim 2, said vehicle sound signal corresponding to vehicle speed comprising at least one of road noise, wind noise, tire noise and water noise.

4. The method of claim 1, wherein the generation of said engine related and vehicle sound signals are controlled independently .

5. The method of claim 1, wherein said engine related and vehicle sound signals are mixed together to produce a combined audio output.

6. The method of claim 1, wherein at least some of said engine control and vehicle control parameters are dynamically varying.

7. The method of claim 1, wherein said engine related and vehicle sound signals are generated concurrently.

8. A method of synthesizing sound signals associated with a vehicle having an engine, comprising:

providing at least one vehicle control parameter which characterizes a corresponding vehicle operating condition other than an engine operating condition, and

generating at least one respective vehicle sound signal corresponding to said vehicle control parameters.

9. The method of claim 8, at least one of said vehicle control parameters comprising vehicle speed.

10. The method of claim 9, said vehicle sound signal corresponding to vehicle speed comprising at least one of road noise, wind noise, tire noise and water noise.

11. The method of claim 8, wherein multiple vehicle sound signals are generated and mixed together to produce a combined audio output.

12. The method of claim 8, wherein at least some of said vehicle control parameters are dynamically varying.

13. A method of synthesizing sound signals associated with a vehicle having an engine, comprising:

providing a plurality of engine control parameters which characterize respective engine control conditions, and

generating engine related sound signals corresponding to said engine control parameters.

14. The method of claim 13, wherein said engine control parameters are provided to an engine process model, and said engine related sound signals are generated in response to an output from said engine process model.

15. The method of claim 14, said engine control parameters comprising at least two of engine rotational speed,

engine load, vehicle acceleration, transmission gear ratio, throttle position, propeller pitch and fuel mixture.

16. The method of claim 14, wherein the outputs from said engine process model comprise engine load, spark event and engine rotational speed signals.

17. The method of claim 16, wherein spark timing controlled sound signals are generated in response to said engine load and spark event outputs from said engine process model.

18. The method of claim 16, wherein direct engine rotational speed sound signals are generated in response to said engine load and engine rotational speed outputs from said engine process model.

19. The method of claim 18, wherein said direct engine rotational speed sound signals are generated by applying said engine load and engine rotational speed outputs to cross-fade loops.

20. The method of claim 18, wherein said direct engine rotational speed sound signals are generated by applying said engine load and engine rotational speed outputs to a feedback FM block.

21. The method of claim 16, wherein engine rotational speed related sound signals are generated in response to said engine load and engine rotational speed outputs from said engine process model.

22. The method of claim 21, wherein said engine rotational speed related sound signals comprise at least one of whistles, whines, engine roar, turbines and FM rumble.

23. The method of claim 16, wherein said engine process model comprises an engine physical model which generates said spark event and engine rotational speed outputs, and a load behavior model which generates said engine load output.

24. The method of claim 23, said engine physical model comprising a starter motor model which provides an initial engine shaft rotational speed signal in response to an engine start control signal, an angular integrator which generates an engine shaft angle signal from said engine shaft rotational speed signal, and a spark timing model that generates said spark event output to simulate the firing of sparks at multiple shaft angles in response to said engine shaft angle signal.

25. The method of claim 24, said engine physical model further comprising a spark force-to-velocity converter that generates an engine shaft rotational speed signal corresponding to said spark event output, and a velocity regulator model that models engine rotational speed regulating factors and is connected to complete a feedback loop from the output of said spark force-to-velocity converter and the input to said angular integrator.

26. The method of claim 14, wherein the outputs from said engine process model comprise engine load and spark event signals which cooperate to generate at least one of engine resonance, air chop, one-shot sound file playback and exhaust system sound signals.

27. The method of claim 26, wherein said engine load and spark event signals cooperate to generate an engine resonance sound signal, and said engine load signal and engine resonance sound signal cooperate to generate a turbulence sound signal.

28. The method of claim 26, wherein said engine load and spark event signals are supplied to an exhaust system model that includes at least one of explosion spreading, turbulence and filtering resonance models to generate said exhaust system sound signal.

29. The method of claim 28, wherein said load and spark event signals are supplied to an explosion spreading model within said exhaust system model which simulates the spreading of the initial pressure wave of an ignition explosion, and only said load signal is supplied to a turbulence model that simulates constrictions and/or bends in an exhaust system waveguide, and a filtering resonance model that simulates an exhaust muffler, the output of said explosion spreading model providing an input to said turbulence model, the output of said turbulence model providing an input to said filtering resonance model, and the output from said filtering resonance model providing said exhaust system sound signal.

30. Apparatus for synthesizing sound signals associated with a vehicle having an engine, comprising:

an engine control input which provides at least one engine control parameter characterizing a corresponding engine operating condition,

a vehicle control input which provides at least one vehicle control parameter characterizing a corresponding vehicle operating condition other than an engine operating condition,

an engine related sound signal synthesizer which generates at least one engine related sound signal corresponding to said engine control parameters, and

a vehicle sound signal synthesizer which generates at least one vehicle sound signal corresponding to said vehicle control parameters.

31. The apparatus of claim 30, at least one of said vehicle control parameters comprising vehicle speed.

32. The apparatus of claim 31, said vehicle sound signal corresponding to vehicle speed comprising at least one of road noise, wind noise, tire noise and water noise.

33. The apparatus of claim 30, wherein said engine related and vehicle sound signal synthesizers are controlled independently .

34. The apparatus of claim 30, further comprising a mixer connected to mix said engine related and vehicle sound signals together to produce a combined audio output.

35. The apparatus of claim 30, wherein said engine control input and vehicle control input provide at least some of said engine control and vehicle control parameters as dynamically varying inputs.

36. The apparatus of claim 30, wherein said engine related and vehicle sound signal synthesizers generate said engine related and vehicle sound signals concurrently.

37. Apparatus for synthesizing sound signals associated with a vehicle having an engine, comprising:

a vehicle control input which provides at least one vehicle control parameter characterizing a corresponding vehicle operating condition other than an engine operating condition, and

a vehicle sound signal synthesizer which generates at least one respective vehicle sound signal corresponding to said vehicle control parameters.

38. The apparatus of claim 37, at least one of said vehicle control parameters comprising vehicle speed.

39. The apparatus of claim 38, said vehicle sound signal corresponding to vehicle speed comprising at least one of road noise, wind noise, tire noise and water noise.

40. The apparatus of claim 37, wherein said vehicle sound signal synthesizer generates multiple vehicle sound signals, and further comprising a mixer connected to mix said vehicle sound signals together to produce a combined audio output.

41. The apparatus of claim 37, wherein said vehicle control input provides at least some of said vehicle control parameters as dynamically varying inputs.

42. Apparatus for synthesizing sound signals associated with a vehicle having an engine, comprising:

an engine control input which provides a plurality of engine control parameters characterizing respective engine control conditions, and

an engine related sound synthesizer which generates engine related sound signals corresponding to said engine control parameters.

43. The apparatus of claim 42, wherein said engine control input provides said engine control parameters to an engine process model, and said engine related sound signal synthesizer generates said engine related sound signals in response to an output from said engine process model.

44. The apparatus of claim 43, said engine control parameters comprising at least two of engine rotational speed, engine load, vehicle acceleration, transmission gear ratio, throttle position, propeller pitch and fuel mixture.

45. The apparatus of claim 43, wherein the outputs from said engine process model comprise engine load, spark event and engine rotational speed signals.

46. The apparatus of claim 45, wherein said engine related sound signal synthesizer generates spark timing controlled sound signals in response to said engine load and spark event outputs from said engine process model.

47. The apparatus of claim 45, wherein said engine related sound signal synthesizer generates direct engine rotational speed sound signals in response to said engine load and engine rotational speed outputs from said engine process model.

48. The apparatus of claim 47, wherein said engine related sound signal synthesizer generates said direct engine rotational speed sound signals by applying said engine load and engine rotational speed outputs to cross-fade loops.

49. The apparatus of claim 47, wherein said engine related sound signal synthesizer generates said direct engine rotational speed sound signals by applying said engine load and engine rotational speed outputs to a feedback FM block.

50. The apparatus of claim 45, wherein said engine related sound signal synthesizer generates engine rotational speed related sound signals in response to said engine load and engine rotational speed outputs from said engine process model.

51. The apparatus of claim 50, wherein said engine rotational speed related sound signals comprise at least one of whistles, whines, engine roar, turbines and FM rumble.

52. The apparatus of claim 45, wherein said engine process model comprises an engine physical model which generates said spark event and engine rotational speed outputs, and a load behavior model which generates said engine load output.

53. The apparatus of claim 52, said engine physical model comprising a starter motor model which provides an initial engine shaft rotational speed signal in response to an engine start control signal, an angular integrator which generates an engine shaft angle signal from said engine shaft rotational speed signal, and a spark timing model that generates said spark event output to simulate the firing of sparks at multiple shaft angles in response to said engine shaft angle signal.

54. The apparatus of claim 53, said engine physical model further comprising a spark force-to-velocity converter that generates an engine shaft rotational speed signal corresponding to said spark event output, and a velocity regulator model that models engine rotational speed regulating factors and is connected to complete a feedback loop from the output of said spark force-to-velocity converter and the input to said angular integrator.

55. The apparatus of claim 43, wherein the outputs from said engine process model comprise engine load and spark event signals which cooperate to generate at least one of engine resonance, air chop, one-shot sound file playback and exhaust system sound signals.

56. The apparatus of claim 55, wherein said engine load and spark event signals cooperate to generate an engine resonance sound signal, and said engine load signal and

engine resonance sound signal cooperate to generate a turbulence sound signal.

57. The apparatus of claim 55, wherein said engine process model supplies said engine load and spark event signals to an exhaust system model that includes at least one of explosion spreading, turbulence and filtering resonance models to generate said exhaust system sound signal.

58. The apparatus of claim 57, wherein said engine process model supplies said load and spark event signals to an explosion spreading model within said exhaust system model which simulates the spreading of the initial pressure wave of an ignition explosion, and only said load signal to a turbulence model that simulates constrictions and/or bends in an exhaust system waveguide, further comprising a filtering resonance model that simulates an exhaust muffler, the output of said explosion spreading model providing an input to said turbulence model, the output of said turbulence model providing an input to said filtering resonance model, and the output from said filtering resonance model providing said exhaust system sound signal.